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Environmental Databases and Other Computerized Information Tools

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Abstract

Increasing environmental legislation has brought about the development of many new environmental databases and software application packages to aid in the quest for environmental compliance. These databases and software packages are useful tools and applicable to a wide range of environmental areas from atmospheric modeling to materials replacement technology. The great abundance of such products and services can be very overwhelming when trying to identify the tools which best meet specific needs. This paper will discuss the types of environmental databases and software packages available. This discussion will also encompass the affected environmental areas of concern, product capabilities, and hardware requirements for product utilization.

Introduction

The increasing promulgation of international, federal, state, and local environmental legislation is affecting all facets of business and industry. Such legislation has become the driving force in the development of many new environmental databases, software programs, and other computerized information products. These databases and related products are useful tools when striving for environmental compliance, and are applicable to a broad range of environmental technology areas. The purpose of this paper is to educate the engineer on the increasing environmental legislation and to provide information on the available electronic computerized information compliance tools.

A greater understanding of environmental legislation is a necessity when trying to appreciate the emerging environmental information tools. The Clean Air Act Amendments of 1990 (CAAA), Montreal Protocol, revised Montreal Protocol (also known as the Copenhagen Protocol) and a presidential executive order are the primary legislative environmental drivers which are greatly challenging the traditional aerospace, production and manufacturing practices. This cadre of legislation encompasses but is not limited to enforcement, regulations, and production bans on various chemicals. The needs for engineers to quickly access large amounts of environmental information has greatly increased.

Title VI of the CAAA mandates a U.S. production ban on Ozone Depleting Substances (ODSs). Chlorofluorocarbons (CFCs), methyl chloroform, and carbon tetrachloride production will cease by January 1, 1996. Hydrochlorofluorocarbons (HCFCs) have varying production phase-out dates from 2003 to 2030 (S. Newman, 3). An article entitled Environmental Initiatives at NASA states that ODSs are utilized in many applications such as surface cleaning, cleanliness verification, laboratory analyses, thermal protection systems and many others (141).

The aerospace engineer must also comply with Title III of the CAAA. This legislation classifies 189 chemical and compounds as Hazardous Air Pollutants (HAPs) (Murphree, 4). HAPs are those chemicals which are carcinogenic, mutagenic, or cause reproductive damage. Examples of HAPs include heavy metals such as chromium, lead and nickel. CAAA, Title III requires the Environmental Protection Agency (EPA) to promulgate 156 National Emission Standards for Hazardous Air Pollutants (NESHAPS) (Murphree, 4). This promulgation began in 1993 and must conclude by 2003. NESHAPs establish federal emission limits for HAPS. NESHAPs also require the usage of Maximum Available Control Technology

(MACT) to curb emission rates.

Volatile Organic Compounds (VOCs), as defined by the EPA, are carbon containing compounds which are not ODSs. VOCs are targeted by the EPA because they are precursors to ambient ozone and other forms of air pollution (SPI, 3). Title I of the CAAA, requires the EPA to promulgate Control Techniques Guidelines (CTGs) for the Aerospace Industry and Shipbuilding Industry. These two industries were singled out in part due to the large acreage of hardware encompassed by these industries. The CTGs will set emission limits on VOCs and require states to utilize Reasonably Achievable Control Technology (RACT).

The aforementioned discussion on environmental legislation illustrates the reasons why the aerospace engineer must now consider environmental compliance when designing a new process or maintaining an established process. A thorough understanding of the process from "the beginning -of-the pipe" to "the end-of-the pipe" is a must. The engineer must assume some of the responsibility for identifying the related environmental impacts of the entire process and review these impacts with the facility's resident Environmental Management Office. Materials replacement technology is a relatively new area and many traditional environmental management offices have greater experience with remediation and permitting issues. Many engineers are discovering that the management of everchanging environmental legislation and related impacts upon traditional manufacturing processes is difficult at best. Furthermore, the typical replacement sequence for materials is five years. This five year time span encompasses identification, evaluation, and requalification of materials.

Accessing and Utilizing Computerized Environmental Information as Compliance Tools

The vast majority of engineering work of today is performed on Personal Computers (PCs) (Zanetti, 5). Many engineers have PCs on their desks and utilize these PCs to write reports, design flowcharts, calculate material balances, and handle accounting. Furthermore, many companies are phasing out mainframes and replacing them with Local Area Networks (LANs) and Wide-Area Networks (WANs). WANs link LANS via leased phonelines thereby allowing an engineer in the U.S. to access a database in another country (Zanetti, 5). These databases allow the engineer to retrieve subsets of information from the abstracts, full text articles, periodicals, wire service stories, newspaper editorials, and professional group newsletters that are collected and periodically updated (McCann , 394-395). Attributes of on-line databases include accessing readily available information without extensive training or specialized equipment, and greater flexibility when conducting a search.

Computerized environmental information is available on several formats including on-line databases, stand-alone databases, CD ROM and other software products and cover a wide range of topic areas. Software products include database programs, EPA/OSHA reporting forms, chemical inventory tracking systems, environmental/chemistry calculation programs, emission monitoring, and EPA test methods. The specialized topic areas encompass pollution prevention/control, waste remediation, environmental legislation , and environmental/chemistry research.

The great abundance of such products and services can be very overwhelming when trying to identify the tools which best meet specific needs. The identification of requirements is the initial step in selecting the most accurate tool. One has to determine the type of environmental information that is to be managed or acquired. It is common to utilize several computerized environmental information products to access or determine different types of information. Furthermore, several databases and related products may be used during the life cycle of a project (design, development, operation, and termination). After identifying the type of environmental information to be acquired/managed, the aerospace engineer can select from the several existing databases and other related software products that are on the market today.

Computerized Environmental Information as an Emerging Technology Area

Several companies and federal agencies have identified the need for computerized environmental information and are responding by developing products and services. Microsoft has the WindowChem Software product line. This product line was founded to provide a distribution network for those programmers working in the Microsoft Windows environment, developing software to solve chemistry related problems (WindowChem , 2). Further information about the WindowChem software product line can be obtained by calling **1-800-536-0404.** Also, the EPA developed the Technology Transfer Network (TNN) which houses sixteen environmental databases and related services. The topic areas range from air monitoring to ecosystem protection. The modem access number is **(919) 541-5472,** and the internet address is **TELNET ttnbbs.rtpnc.epa.gov.** Brief descriptions of the available products are provided.

Accessing Legislation/Regulations

The myriad of everchanging federal, state, and local legislation is difficult to track. However, this type of information is essential due to the regulatory impacts upon current and future projects. Several computerized products and services are available to ease this never-ending task.

- **Clean Air Act Amendments BB (CAAA)**
  - on-line database devoted to Clean Air Acts Amendments
  - bulletin board service
  - full text of proposed Hazardous Organic NESHAP
  - EPA sponsored
  - downloadable
  - Technology Transfer Network (TNN)
  - free cost
  - modem # / (919) 541-5742
  - Internet address / TELNET ttnbbs.rtpnc.epa.gov

- **Regscan for Windows and MACs**
  - stand-alone
  - contains final/proposed rules for Code of Federal Regulations (CFR) 40, CFR 49 (and other CFRs), also the complete Federal Register
  - includes state safety and environmental regulations
  - manufactured by Regulation Scanning Company
  - $500 (starting price)
  - company phone # / 1-800-326-9303

Researching Environmental and Chemistry Journals

Oftentimes the aerospace engineer encounters specialized technical challenges. The environmental and chemical journals enable the engineer to stay abreast of the "state-of -the-art" developments in specific technology areas. This on-line capability also allows engineers to search on the needed subject matter, and does not require a lot of space as does hard copies.

- **Chemistry Journals of the American Chemical Society (CJACS)**
  - 127,000 records contained in on-line database
  - approximately 22 journals (e.g. "Environmental Science & Technology,

Chemistry of Materials)
- searchable information (except for some mathematical and chemistry equations)
- Scientific and Technical Information Network (STN)
- $29/hr connect fee (display and search fees applicable)

♦ **Environment Reporter**

- contains complete test of current developments section
- information on federal/state legislation, pollution control
- Westlaw network (offers several environmental databases)
- subscription cost is $125/year
- user cost is $4.05/minute
- CD ROM is $6, 748
- additional networks: Dialog, Lexis
- prices vary per network

Identifying Physical and Chemical Properties of Materials

The engineer will also discover that many environmental databases contain chemistry information and that many chemistry databases contain environmental information. The physical and chemical properties of materials is important information to have when replacing an environmentally non-compliant material with a compliant material. The reactivity and stability data in useful in determining the shelf-lives of materials. Much of this type of information is contained within Chemistry databases.

♦ **Environmental Chemicals Data and Information Network (ECDIN)**

- on-line databases
- chemical identification of 122,400 chemical compounds
- contains 19 files : physical/chemical properties, chemical processes, toxicity information (20,000 compounds)
- internationally produced (Commission on the European Communities & others)
- DIMDI network
- phone #/ 0332 789720

♦ **EM Science Chemicals Information System (EMCIS)**

- WindowChem software
- stand-alone database
- physical/chemical properties
- stability/reactivity data
- toxicity data
- requires Windows 3.x, Excel 4.0
- $395
- phone #/ 1-800-536-0404

Implementing Materials Replacement Technology

Materials Replacement Technology is an emerging technology area. As previously stated throughout the text, the project engineer will have to assume increasing responsibility for ensuring that environmental compliance is achieved and maintained during the life cycle of a project. The NASA Operational Environment Team (NOET) has developed two unique databases to assist with materials replacement tasks.

- NASA Environmental Information System (NEIS)

  - on-line database within the Materials & Processes Environmental Engineering Network (MPEEN) database
  - contains information on legislation/regulations
  - physical/chemical properties of solvents and other cleaning materials
  - cleaning evaluation results
  - free access
  - Internet # /128.158.1.200
  - modem #/1-800-320-6272
  - point of contact /Ms. Beth Cook, (205) 544-2545

- Aero-Mat

  - contains usage and volatile organic content (vc) of materials
  - identifies specification drivers
  - contains specification drivers
  - stand-alone database (will eventually merge into NEIS)
  - currently limited access

Accessing Analytical Test Methods (EPA and Others)

The electronic test methods enable the chemists or engineer to search and identify all the test methods that use utilize a certain chemical as the anlalyte. One can also retrieve several test methods to determine the suitability of needs. These test methods aid in the customization of standard operating procedures because the chemist can "cut & paste" , and combine the appropriate sections of the various methods.

- Electronic Methods for EPA/ National Institute of Occupational Safety and Health NOSH) / Occupational Safety and Health Administration (OSHA)

  - WindowChem product
  - stand-alone database
  - EPA waste & water methods, air toxic methods (and many others)
  - information is searchable by method#, analyte, CAS #, instrumentation
  - prices vary ($300 - $1100)
  - various subscription plans available
  - phone # / 1 - 800 - 536 -0404

- Environmental Monitoring Methods Index (EMMI)

  - EPA sponsored
  - stand -alone database
  - contains information on 2600 of EPA's regulated chemical substances
  - summaries of 926 analytical methods
  - manufacturers of analytical standards
  - regulatory limits
  - $385 - $1995
  - phone # / (703) 487-4650

Complying With Air Emissions Standards

The increasing promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP) will require closer monitoring of the emissions released from 174 targeted source categories. Several products are available to guide the engineer through the air emissions permitting process. Also, many products have been developed to provide air -dispersion modeling capabilities.

- Breeze Dispersion Models

  - product line contains 35 air dispersion modeling programs
  - several modeling programs approved by the EPA
  - menu -driven programs (help screens, tutorials)
  - guides user through data entry, model execution / plot generation for continuous emissions from stacks, mobile sources & accidental releases
  - access to technical support
  - $450 (starting cost)
  - phone # /(214) 661-8100

- Controlling Air Tonics (CAT) Version 1.0

  - EPA - sponsored
  - stand - alone database
  - assists in review of air emissions permit applications
  - provides guidance on control devices
  - calculates design parameters
  - estimates costs for control devices
  - $55
  - phone # / (703) 407-4650

Chemical Inventory Management

Two common tasks associated with the chemical management process are chemical inventory and the management of Material Safety Data Sheets (MSDSs). Each tasks is extremely important in achieving environmental compliance. However, these tasks are typically time consuming, cumbersome and entails numerous amounts of paper. Several computer programs are available to automate these tasks, and provide paperless chemical management.

- Chemical Inventory Software (CIS)

  - WindowChem software
  - tracks chemicals and other materials
  - provides descriptions of general hazards
  - provides specification of vendor and catalog numbers
  - identifies storage locations
  - $199
  - phone # / 1 - 800 - 536-0404

- ♦ Material Safety and Data Sheet (MSDS) Manager Perform Pro Template

  - WindowChem Product
  - designed for the specialty chemical manufacturer
  - allows engineers and chemists to write, publish , store, and distribute their own MSDSs
  - stores all MSDSs in one electronic location
  - merges vendors MSDSs/ extracts vendors MSDSs
  - $199
  - phone # / 1 - 800- 536 - 0404

Performing Mathematical Calculations and chemical conversions

Several computerized products are available to assists the chemist or engineer with chemical conversions, mathematical calculations, and environmental calculations. These products save time and reduce errors caused by calculations. The following programs are WindowChem products and the phone number is 1-800-536-0404.

- ♦ Chemical Conversions

  - drop down menus to convert 2000 different unit conversions
  - unit conversion include mass, pressure , volume , flow rates, energy, concentration
  - $89

- ♦ Environmental Molecular Weight Calculator 2.0

  - formula database of over 1000 environmentally regulated compounds
  - chemical formulae of compounds from EPA methods (Water & Waste)
  - calculates amount to add to given volume of liquid to make desired solution concentration
  - $119

- ♦ Special Environmental Calculations Macros

  - reporting for waste, water, chloride content
  - utilizes Excel to automate reporting of environmental samples
  - macros are same mathematics as used in EPA methods
  - $39 - $1495

Conclusion

Computerized environmental information offers several benefits . The databases provide greater flexibility when searching for specific information resulting in a time savings. This information can be captured and brought in-house. Also, the paperless engineering minimizes the physical space required to store information.

The environmental information products provide services that replace the manual tasks performed by engineers and chemists at one time or another. These services include automation of the chemical

inventory process; customization of MSDSs; ease in creating customized Standard Operating Procedures; and aiding in the air permitting process. Additional benefits from these products are reduction in redundancy of material replacement efforts; current status of environmental regulations and legislation; easy access to EPA analytical test methods; and less manual number crunching when performing chemical /environmental unit conversions.

In summary, engineers will face increasing challenges when striving for environmental compliance. These global challenges will drive the development of emerging technologies for environmental compliance. Computerized environmental information of varying formats and topic areas will be utilized.

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